Claims:

1. A perpendicular magnetic recording medium, comprising:

a non-magnetic amorphous metal layer containing Ni, which is formed on a substrate; and

a perpendicular magnetic recording layer formed on the non-magnetic amorphous metal layer containing Ni.

2. A perpendicular magnetic recording medium, comprising:

a soft magnetic underlayer formed on a substrate;

a non-magnetic amorphous metal layer containing Ni, which is formed on the soft magnetic underlayer; and

a perpendicular magnetic recording layer formed on the non-magnetic amorphous metal layer containing Ni.

3. The perpendicular magnetic recording medium according to claim 1, wherein said non-magnetic amorphous metal layer containing Ni contains Zr.

4. The perpendicular magnetic recording medium according to claim 3, wherein said non-magnetic amorphous metal layer further contains at least one of Nb and Ta.

5. A perpendicular magnetic recording medium, comprising:

a soft magnetic underlayer having ferromagnetic nano-crystals, which is formed on a substrate; and

a perpendicular magnetic recording layer formed on the soft magnetic underlayer via a non-magnetic intermediate layer.

6. The perpendicular magnetic recording medium according to claim 5, wherein in said soft magnetic underlayer, a nano-crystal contrast is observed in a transmission electron microscopic image, which is measured by allowing an electron beam to be incident in a perpendicular direction to a film surface, and in a transmission electron microscopic image, which is measured by allowing an

electron beam to be incident in a parallel direction to a film surface.

7. The perpendicular magnetic recording medium according to claim 5, wherein in said soft magnetic underlayer, diffraction peaks 110, 200 and 211 of α-Fe appear on a thin-film X-ray diffraction profile, which is measured by fixing an X-ray incident angle θ at 2 degrees.

8. The perpendicular magnetic recording medium according to claim 5, wherein in said soft magnetic underlayer, diffraction rings 110, 200 and 211 of α-Fe are observed in an electron diffraction image, which is measured by allowing an electron beam to be incident in a perpendicular direction to a film surface, and in an electron diffraction image, which is measured by allowing an electron beam to be incident in a parallel direction to a film surface.

9. The perpendicular magnetic recording medium according to claim 5, wherein said soft magnetic underlayer contains Fe as a first element, at least one of C and N as a second element and at least one kind of element selected from Ta, Hf, Nb, Ti and Zr as a third element.

10. A perpendicular magnetic recording medium, comprising:

a soft magnetic underlayer containing Fe, Ta and C;

a non-magnetic amorphous intermediate layer containing Ni, Ta and Zr, which is formed on the soft magnetic underlayer; and

a perpendicular magnetic recording layer formed on the non-magnetic amorphous intermediate layer.

11. A magnetic storage apparatus, comprising:

a perpendicular magnetic recording medium having a soft magnetic underlayer, a non-magnetic amorphous metal layer containing Ni formed on the soft magnetic underlayer, and a perpendicular magnetic recording layer formed on the non-magnetic

amorphous metal layer containing Ni;

a driver for driving the perpendicular magnetic recording medium in a recording direction;

a magnetic head consisting of a recording section and a reproduction section;

means for allowing said magnetic head to have a relative movement for said perpendicular magnetic recording medium; and

recording-reproduction processing means for performing signal input to said magnetic head and reproduction of output signal from the magnetic head,

wherein said magnetic head reproduction section is constituted of a high-sensitive layer utilizing any one of a magnetoresistive effect and a tunneling magnetoresistive effect.

12. A magnetic storage apparatus, comprising:

a soft magnetic underlayer having α-Fe nano-crystals;

a perpendicular magnetic recording medium having a perpendicular magnetic recording layer, which is formed on the soft magnetic underlayer via a non-magnetic intermediate layer;

a driver for driving the perpendicular magnetic recording medium in a recording direction;

a magnetic head consisting of a recording section and a reproduction section;

means for allowing said magnetic head to have a relative movement for said perpendicular magnetic recording medium; and

recording-reproduction processing means for performing signal input to said magnetic head and reproduction of output signal from the magnetic head,

wherein said magnetic head reproduction section is constituted of a high-sensitive layer utilizing any one of a

magnetoresistive effect and a tunneling magnetoresistive effect.